

US District Court
Eastern District of NY

 ORIGINAL

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U.S. DISTRICT COURT E.D.N.Y.

Gilbert Roman, Plaintiff,

CV-09 2504

COMPLAINT

★ MAY 29 2009 ★

v.
NRO,

Defendants,

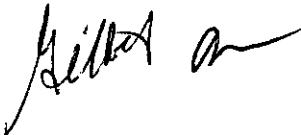
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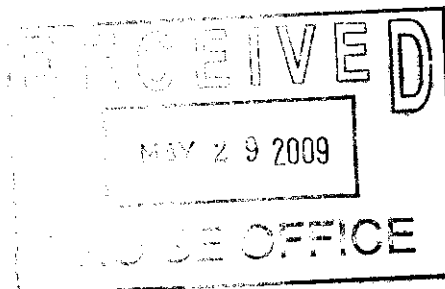
I request a court ORDER ordering the release of all requested information from the NRO. On March 3, 2009 a Freedom of Information Act and/or Privacy act request was sent to the NRO at 14675 Lee rd., Chantilly, VA 20151. This request was never answered. Exhibit A will Show proof of service. On May 18, 2009 the same request was sent again Exhibit A will show Proof of service. On May 21, 2009 they respond. They refuse to process my request. They State I make a series of questions and they do not have to answer questions. Exhibit B will Show there response. In my opinion I made a reasonable request and the obstruction of Justice is rampeted in my cases against the gov't. They also state that I did not offer to pay for Processing. I have no problem paying whatever it cost to prove the violations of our constitution. They have violated civil, criminal rights of Americans in America. They have no excuse for these Violations as history and time will prove. The Nazi party and Hitler also had there countries Interest in mind. We know how that turned out. No exemption can violate a single right of Americans without being checked and cross checked for truth. Exhibit C will show my request. As the proof of the existence of such technology is slowly coming to light. Exhibits 1 - 10 show The support the existence of technology that allows the gov't to read our thoughts. I have kown about This technology since about 1998. I have been slowly trying to prove its existence and the illegal Uses of such technology. I will be supplying the court with much more papers of support.


(SI)
BIANCO, J.

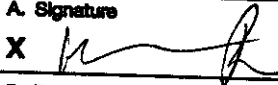
WALL, M.J.

Gilbert Roman Pro Se
95-25 77th st
Ozone Pk., NY 11416
516-458-92105

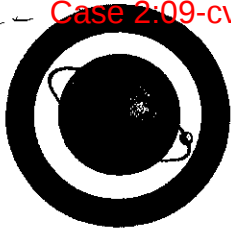




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Exh. b.7 A



NATIONAL RECONNAISSANCE OFFICE

14675 Lee Road
Chantilly, VA 20151-1715

21 May 2009

Gilbert Roman
95-25 77th Street
Ozone Park, NY 11416

Dear Mr. Roman:

This is in response to your letter, dated 14 May 2009, received in the Information Management Services Center of the National Reconnaissance Office (NRO) on 20 May 2009. Pursuant to the Freedom of Information Act (FOIA), you requested:

- "1. ...information on functional magnetic resonance imaging.
2. The date it was put into service.
3. The first successful report on the first person it was used on successfully."

In your letter, you referenced an earlier request dated 9 March, 2009. We have no record of receipt of that request.

We are unable to process your request since it falls outside the parameters of the Freedom of Information Act, 5 U.S.C. § 552, as amended. We are precluded from conducting research to answer questions and/or requests for information, and may not create records in response to a request for records. We can only search for existing records, which have been requested with sufficient specificity (as to their type, origin, etc.) to conduct an organized, non-random search of our records systems.

Additionally, your request did not indicate a willingness to pay any charges incurred. Under the procedural requirements of Department of Defense Regulation 5400.7-R published at 32 CFR 286 (Vol. 52, No. 132, September 1998), requesters must indicate a willingness to pay assessable fees. Additional information about fees can be found on our website at www.nro.gov. Our website also includes additional information about what the NRO does and instructions for submission of a proper FOIA request.

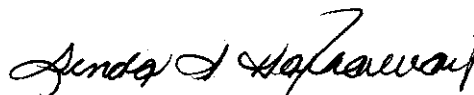
Please be assured that this is not a denial of your request, but merely an explanation as to why no further action can be taken to process your request as originally presented. We will hold your request in abeyance for thirty days from the

Exh. b. + b

date of this letter. If we do not hear back from you within that 30-day period, we will administratively close this case.

If you have any questions, please call the Requester Service Center at (703) 227-9326 and reference case number F09-0063.

Sincerely,

A handwritten signature in black ink, appearing to read "Linda S. Hathaway". The signature is fluid and cursive, with the first name "Linda" and last name "Hathaway" clearly distinguishable.

Linda S. Hathaway
Chief, Information Access
and Release Team

Gilbert Roman
95-25 77th st.
Ozone pk. NY 11416

Let us open with a new request under the Freedom of Information Act 5 USC Sec. 552 and or Privacy Act of 1974. My request is as follows:

1. I request information on Functional magnetic resonance imaging.
2. The date it was put into service.
3. The first successful report on the first person it was used on successfully.

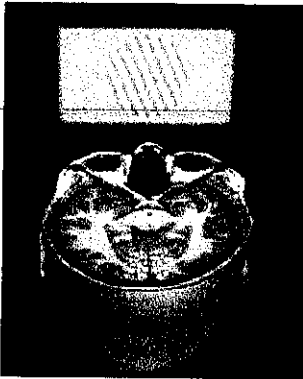
Thank You

Exhibit B C

It is 13 the technology I've known about since 1987
It is real, It is now, it is not frivolous.

How could I know about this, if I did not have first hand knowledge
All I need is to acquire the proof!

Time & History reveal all things!



Big Brother is watching you: Researchers used fMRI to peer into the visual cortex of a subject and accurately predict which of two images (circular grating, above) he was holding in his short-term memory. The experimenters used specialized algorithms to tease out subtle patterns in brain activity (represented here in red and green) specific to that image in order to make the call. Credit: Stephenie Harrison and Frank Tong

This is the technology we really need to protect from

Functional magnetic resonance imaging (fMRI) looks more and more like a window into the mind. In a study published online today in *Neuron*, researchers at MIT report that from fMRI data alone, they could distinguish which of two images subjects were holding in their memory—even several seconds after the images were removed. The study also pinpointed, for the first time, where in the brain visual working memory is maintained.

Visual working memory allows us to briefly store and act upon specific details from images that we've seen: what color they are, how they're oriented, and how frequently they appear. But how and where these details are stored has remained a mystery. Early visual areas, which are the first to receive and process visual information, don't seem to stay active long enough to do the job. And higher visual areas don't have the machinery to retain such fine-grained details.

"It's been elusive," says *John J. Gold*, a neuroscientist at the Bernstein Center for Computational Neuroscience, in Berlin. "This is a truly brilliant study that now convincingly demonstrates that the information about fine-grained contents of visual experience is held online in the early visual cortex across memory periods."

In the study, subjects were briefly shown two subsequent images of a grating, each image oriented at a different angle. They were then given a cue telling them which one to remember. To ensure that the memory was maintained, subjects were shown a third grating several seconds later and prompted to indicate how it was rotated compared with the remembered one. Throughout the whole process, an fMRI scanner monitored activity in four different early visual areas of the brain.

By analyzing the activity in those areas during the 11-second remembering period, the experimenters were able to determine, with more than 80 percent accuracy, which grating orientation the subject had in mind. To do so, they used a sophisticated analytical tool called a pattern classifier, calibrated for each individual subject by a number of training trials. Rather than simply measuring the overall level of activity, the pattern classifier could probe for patterns in how that activity was distributed across the brain.

This approach turned out to be crucial. Previous studies had unsuccessfully tried to predict subjects' memories by looking at overall brain activity in the early visual areas—an approach that was similarly unsuccessful here. In roughly half of the subjects, overall activity returned to baseline levels soon after the images were removed from view, and in all subjects activity was drastically reduced, making it impossible to decode which image the subject was remembering. But by teasing out specific activity patterns, the pattern classifier was able to reveal the previously hidden information encoded in those areas.

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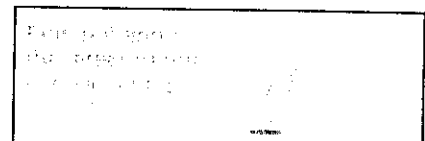


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Notes

Update

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Letters

Detecting deception from neuroimaging signals – a data-driven perspective

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In their recent article, Sip and colleagues raise several criticisms that question whether neuroimaging is suitable for lie detection [1]. Here, two of their points are critically discussed. First, contrary to the view of Sip *et al.* [1], the fact that brain regions involved in deception are also involved in other cognitive processes is not a problem for classification-based detection of deception. Second, I disagree with their proposition that the development of lie-detection requires enriched experimental deception scenarios. Instead, I propose a data-driven perspective whereby powerful statistical techniques are applied to data obtained in real-world scenarios.

Sip and colleagues correctly note that 'a specific region of the brain is very rarely affiliated only to one [...] cognitive process'. As an example, they discuss the anterior cingulate cortex (ACC), which exhibits increased activity during deception; however, the ACC is also active in other processes that do not involve deception. Thus, as Sip and colleagues correctly point out, it would be a logical fallacy to infer from activity in the ACC alone whether a subject is lying. And this is correct: reverse inferences do indeed require caution [2]. But current state-of-the-art neuroimaging of deception takes a different approach that does not attempt to detect deception from activity in single brain regions [3]. Instead, the entire distributed spatial pattern of brain activity is taken into account by a computer-based classification algorithm, the aim of which is to identify a unique profile of activation that is indicative of deception. This approach offers a very promising tool for detecting deception in single subjects based on neural activity across brain regions [3,4]. Importantly, it does not matter if individual brain regions are involved in multiple cognitive processes, including those other than lying, as long as the classifier can distinguish between deception and truth from the full spatial pattern of brain activity. Also, a

suitable classifier will deal with the fact that lies and their corresponding brain-activity patterns can be quite different [5] (Figure 1). The argument can again be made that inference of a cognitive process such as deception from distributed patterns of brain activity also relies on reverse inference. However, it should be noted that any empirical indicator of deception (or of any mental process or other diagnostic or medical test) suffers from a problem of reverse inference. The key point in all diagnostics is the selectivity and specificity of the measurement, which can be clearly formalized [2] and parameters for diagnostic inferences are routinely determined by empirical research.

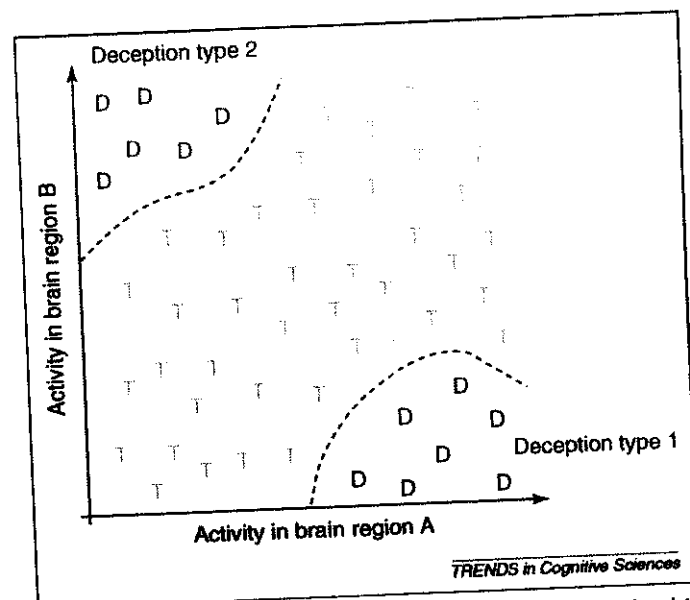


Figure 1. Detection of multiple categories of deception from brain-imaging data. Each point shows the hypothetical brain activity in two brain regions during truth-telling (T) or deception (D). A non-linear pattern classifier can separate deception from truth even when different types of lie have non-contiguous brain activation patterns [5].

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It has already been shown that spatial patterns of brain activity have a considerably higher sensitivity and selectivity for detecting mental processes than activity in individual regions [6]. Importantly, such a data-driven approach for detecting deception based on pattern classification does not necessarily require a neurocognitive theory of deception. Instead, it would be sufficient to obtain training data by conducting neuroimaging in real criminal investigations [7]. This would constitute a maximally realistic scenario, ideally for which it was not known whether the suspect had committed the crime or not. Cases in which independent evidence becomes available after scanning on whether the person was lying or telling the truth will provide the best way to train the program. Thus, the accuracy of a neuroimaging lie-detector would be most clearly validated, which is more than can be said for other widely used methods for assessing truth [8]. The question of whether different types of lies and different contexts are a problem for neuroimaging-based lie-detection can be answered by assessing the degree to which data from such real-world scenarios can be correctly classified. It should be an ethical imperative to use the best available methods for assessing deception and, hence, the question of whether

a neuroimaging-based lie-detection should be used is a matter of its success as determined from empirical data in realistic settings.

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Letters Response

Response to Haynes: There's more to deception than brain activity

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Haynes outlines a programme for using the new voxel-wise categorization technique in functional magnetic resonance imaging (fMRI) for detecting deception [1]. The imaging methodologies he proposes are undoubtedly the best currently available. However, they depend on the existence of independent categorization of deceptive and non-deceptive intentions in each of the subjects being scanned, which is the weak point of his proposal. Valid experimental paradigms for eliciting deception are still required, and such paradigms will be particularly difficult to apply in real-life settings. Furthermore, it is known that brain activity is markedly affected by the subjects' beliefs about the situation rather than objectivity [2,3]. In two such studies [2,3], brain activity depended on whether subjects thought they were interacting with a person or a computer, even though, objectively, the sequence of stimuli they experienced were the same in both conditions. In such cases, the state of the subject can only be confirmed by subjective report. Deception is a subjective intention rather than objective state.

Consider, for example, the situation in which someone tells the truth with the subjective intent to deceive. In this example, there is no objective marker of intent. Can we rely on the reliability of subjective reports in a forensic setting to supply our independent marker of deception? Moreover, in such settings, it is well known that witnesses often disagree as to what actually happened. So, it seems highly problematical to presume that independent evidence will always be available to indicate whether a person is lying or telling the truth. In a forensic situation, we believe that the question 'is this person being deceptive' is not the correct one to ask, especially if we are to rely solely on measures of neural activity. Rather, we should ask questions about objective states, as in the guilty knowledge test [4], such as 'has this person seen this object before'. We agree with Haynes, however, that there are important ethical issues at stake for researchers in this field. In our opinion, one of the most important of these is careful consideration of how results derived from highly controlled laboratory settings compare with those obtained from real-life scenarios, and if and when imaging technology should be transferred from the laboratory to the judicial system.

Report

Reading Hidden Intentions
in the Human Brain

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Summary

When humans are engaged in goal-related processing, activity in prefrontal cortex is increased [1, 2]. However, it has remained unclear whether this prefrontal activity encodes a subject's current intention [3]. Instead, increased levels of activity could reflect preparation of motor responses [4, 5], holding in mind a set of potential choices [6], tracking the memory of previous responses [7], or general processes related to establishing a new task set. Here we study subjects who freely decided which of two tasks to perform and covertly held onto an intention during a variable delay. Only after this delay did they perform the chosen task and indicate which task they had prepared. We demonstrate that during the delay, it is possible to decode from activity in medial and lateral regions of prefrontal cortex which of two tasks the subjects were covertly intending to perform. This suggests that covert goals can be represented by distributed patterns of activity in the prefrontal cortex, thereby providing a potential neural substrate for prospective memory [8–10].

During task execution, most information could be decoded from a more posterior region of prefrontal cortex, suggesting that different brain regions encode goals during task preparation and task execution. Decoding of intentions was most robust from the medial prefrontal cortex, which is consistent with a specific role of this region when subjects reflect on their own mental states.

Results

We directly addressed whether the current intentions of a subject were encoded in specific regions of prefrontal cortex. This was achieved by assessing whether multivariate pattern recognition [11] could be used to decode that subject's covert intention from activity patterns in prefrontal cortex. If a cortical region indeed represents a current intention, it must have some way of encoding a set of different potential goals. One possibility is that it uses a spatial code, with different, spatially segregated neural subpopulations encoding different intentions. Unfortunately, because of the limited spatial resolution of human neuroimaging, most researchers have restricted their analyses to activity averaged across extended regions of cortex. This leaves unclear whether there are any regions encoding intentions in a spatially distributed fashion. However, it has recently emerged that functional magnetic resonance imaging can be used to study fine-grained neural representations, even when they are encoded at a finer scale than the resolution of the measurement grid [12, 13]. This technique is powerful enough to reveal distributed representations of visual images in occipital and temporal brain areas [11–14].

In order to investigate whether a subject's current intentions are reflected in such distributed response patterns in prefrontal cortex, we required subjects to freely select what task they wished to perform. Specifically, they chose either adding or subtracting two numbers (Figure 1). After the subject had freely decided upon one of the two tasks, there was a variable delay of between 2.7 and 10.8 s, after which the task-relevant material (two numbers) was presented. The variable delay rendered the onset of the task-relevant material unpredictable and thus required the subject to maintain a high state of preparation even across long intervals [10]. Shortly after the two numbers, a response screen was presented that contained four numbers: one was the correct answer for addition, one was the correct answer for subtraction, and the two other numbers were similar but incorrect numbers. Subjects only rarely chose one of the two incorrect numbers (average 5%), indicating that they were correctly performing the task and not responding randomly. From the choice of one of the two correct answers, it was possible to infer which task the subject had chosen for the current trial. However, it is important to note that there was no way of telling which task the subject had freely selected prior to the response, because there was no explicit instruction

*Correspondence: haynes@cbs.mpg.de

Exhibit 5

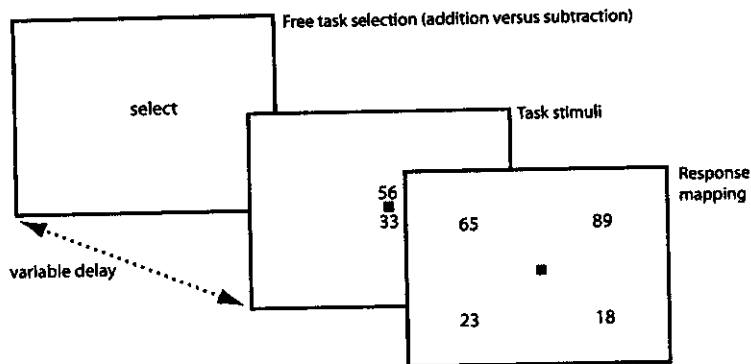


Figure 1. Delayed Intention Task

At the beginning of each trial, the word "select" was presented that instructed the subjects to freely and covertly choose one of two possible tasks, addition or subtraction. After a delay during which subjects covertly maintained their intention, two numbers were presented and subjects were then required to perform the selected task (addition or subtraction) on the two numbers. A response screen then appeared showing two correct answers (for either addition or subtraction) and two incorrect answers. Subjects pressed a button to indicate which answer was correct for the task they had performed. From the button press, it was possible to determine the covert intention of the subject during the previous delay period.

and no behavioral response prior to the onset of the response screen, and subjects responded randomly (see Figure S1 in the Supplemental Data available online). Also, because the arrangement of numbers on the response screen was random, there was no possibility for the subject to prepare their motor response. This ensured that any information we could decode from brain activity during the delay was not related to covert preparation of motor responses [4, 5].

We recorded brain responses with functional magnetic resonance imaging at 3 Tesla while subjects were performing the free-selection task. In order to investigate which cortical regions encode the subject's current intention, we next assessed whether it was possible to decode from the spatial pattern of signals in each local region of the brain which intention the subject was covertly maintaining [11–14]. For this, we applied multivariate pattern recognition to spatial patterns of brain responses under the two possible intentions (see Experimental Procedures and Figure 2 for details on this analysis). We found that indeed several regions predicted whether the subject was currently covertly intending to perform the addition or subtraction task (Figure 2). The highest decoding accuracy of 71% was achieved in medial prefrontal cortex ($T_{(7)} = 4.62$, $p = 0.001$, see Figure 2, "MPFCa"). Importantly, however, decoding in this region was not possible during task execution, suggesting that the intention was encoded in this brain region only during the delay and not during task execution. In contrast, a region more superior and posterior along the medial wall was not informative during the delay, but only during the execution of the freely chosen task (Figure 2, "MPFCp"). Besides medial prefrontal cortex, there were also several regions of lateral prefrontal cortex where decoding accuracy was lower, but still above chance level (Figure 2). Also in these regions, decoding was at chance level during task execution. Interestingly, only a region of anterior-medial prefrontal cortex showed an overall increase of activity during the delay period while subjects had covertly formed a decision but were still waiting to execute the task (Figure S2). As in previous studies [10, 15], the duration of increased neural activity corresponded to the delay in the current task, with longer delays leading to longer fMRI responses. However, this region with an overall signal increase was more anterior to the region that encoded the subject's intentions. Importantly, there was no difference

between the two intentions in the overall level of activity ($T_{(7)} = -0.46$; $p = 0.67$) in medial prefrontal cortex, suggesting that the intentions were not encoded in different global levels of activity but in the detailed spatial patterns of cortical responses.

Discussion

To summarize, we have demonstrated that regions of both medial and lateral prefrontal cortex contain localizable task-specific representations of freely chosen intentions. In accordance with our findings, activity in several regions of human prefrontal cortex (including the frontopolar, lateral, medial, and prefrontal cortex) is increased during diverse executive processes such as attending to and thinking about intentions [16, 17], task-switching [18–20], set-shifting [21], multitasking [22], storing goals over a delay period [9, 10, 15, 23], branching and processing of subgoals [24, 25], and free task selection [26]. However, these previous studies left unclear whether any region of prefrontal cortex actually encodes signals that are specific for the current task. Increased levels of activity during task preparation might instead reflect unspecific preparatory signals, such as maintaining a representation of the set of all potential choices [6], tracking the memory of previous responses [7], or general preparation. Our new findings resolve this crucial question by showing for the first time that prefrontal cortex encodes information that is *specific* to a task currently being prepared by a subject, as would be required for regions encoding a subject's intentions. In accordance with our findings, single cells in monkey lateral prefrontal cortex can prospectively encode expectations about task-relevant information [27]. Furthermore, ensembles of neurons in this region exhibit a gradual increase in the information about simple saccadic movement sequences while animals learn to perform a sequence correctly [28]. Cells have also been reported in the same area that code for specific moves while the monkey is waiting to move a cursor so as to negotiate a maze [29]. Here we show that in humans, a network of brain regions, including not only lateral but also medial prefrontal cortex, contains such task-specific representations.

Although intention-related information was encoded in both lateral and medial regions of prefrontal cortex, decoding accuracy was highest in the medial region.

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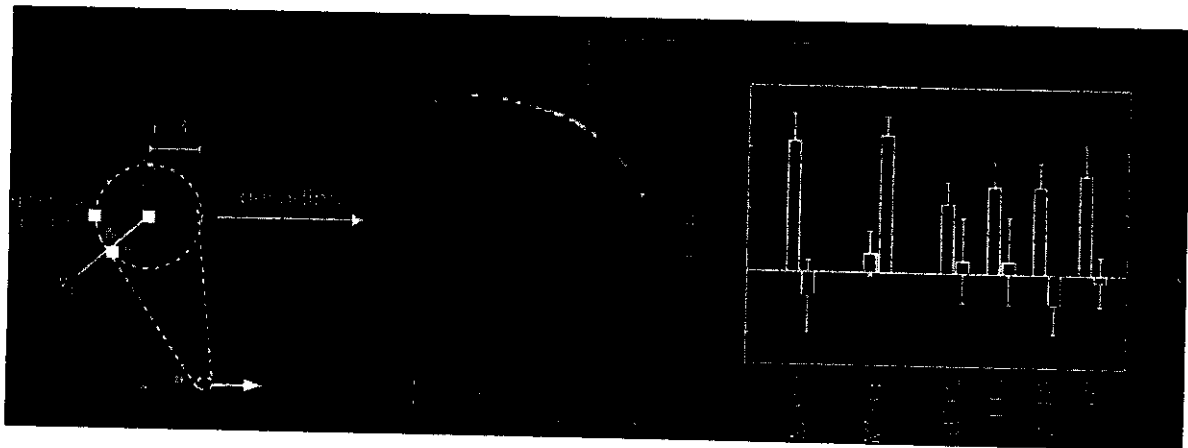


Figure 2. Brain Regions Encoding the Subjects' Specific Intentions during Either Delay or Execution Periods

In order to search in an unbiased fashion for informative voxels, we used a "searchlight" approach [44], which examines the information in the local spatial patterns surrounding each voxel v_i .

Left: A spherical searchlight centered on one voxel (v_i) was used to define a local neighborhood. For each scanning run, the spatial response pattern in this local spherical cluster was extracted during preparation of either subtraction or addition. We then trained a pattern classifier with a subset of the data to recognize the typical response patterns associated with covert preparation of the two mathematical operations (see Experimental Procedures) and measured the local decoding accuracy. Then, the searchlight was shifted to the next spatial location.

Middle: Highlighted in green are medial brain regions (superimposed on a sagittal slice of an anatomical template image) where this local classifier was able to decode significantly above chance which intention the subjects were covertly holding in an independent test data set. Highlighted in red are regions where it was possible to decode the intention during the execution of the task.

Right: Decoding accuracy in searchlight locations with above-chance decoding during the delay period (MPFCa, anterior medial prefrontal cortex [MNI 3,42,15]; MPFCp, posterior medial prefrontal cortex [MNI 11,32,38]; LLFPC, left lateral frontopolar cortex [MNI -36,54,12]; LIFS, left inferior frontal sulcus [MNI -2,36,12]; RMFG, right middle frontal gyrus [MNI 48,24,45]; LFO, left frontal operculum [MNI -39,9,9]; error bars indicate SEM). In the anterior medial prefrontal cortex (MPFCa), decoding during the delay (green bars) was highest but was at chance level during the task execution (red bars) after onset of the task-relevant stimuli. In contrast, a more posterior and superior brain region on medial prefrontal cortex (MPFCp) encoded the chosen task only once it had entered the stage of execution, but not during the delay period. Several other regions of lateral prefrontal cortex also encoded information during the delay, but not during the execution period.

One possible explanation may be that the current study allowed subjects to freely select which task to perform, whereas in most previous studies the task goal was specified by the experimenter. Medial prefrontal cortex is especially involved in the initiation of willed movements and their protection against interference [30]. Increased levels of medial activation are also found when task sets have to be internally generated as opposed to being fully externally cued [26, 31] and in similar cases of underdetermination [32–34]. For example, a direct comparison between voluntary task selection and externally cued tasks shows increased activation in medial, not lateral, prefrontal regions [31] during the free selection of tasks. Medial frontal cortex is also activated when subjects reflect on their own mental states [35, 36]. Interestingly, we also observed a division of labor between posterior and anterior regions of medial prefrontal cortex, where the anterior regions encode goals during preparation whereas the posterior regions encode goals during task execution (Figure 2). This is consistent with suggestions by previous authors that there is an anterior/posterior gradient on the medial frontal surface [26]. Similarly, the area at which activity is enhanced when subjects attend to their intention to perform a simple finger movement is more anterior than the area at which activity is enhanced when they attend to the finger movement itself [17, 34].

An interesting question for future research is the degree to which the encoding in different prefrontal areas reflects sustained maintenance of intentions across multiple trials, or trial-by-trial switching of intentions.

Because of the random trial-by-trial alternation of subjects in our study, we measured predominantly shift-trials (see Figure S1), and therefore we are unable to address the differences between sustained and transient encoding. Previous studies have reported evidence for both sustained [20] and shift-related [37] activity in medial prefrontal cortex, so it would be interesting to apply similar decoding-based techniques to cued paradigms where the number of switch and stay trials can be better balanced.

An important feature of our paradigm is that it ensured that subjects could not covertly prepare for a specific movement prior to the onset of the response-mapping screen. This is in contrast to previous studies on prospective coding that used event-related potentials. These studies have shown that it is possible to decode on a single trial whether subjects are going to choose to move the left or right fingers [5] and that this information is present even prior to the time at which the subjects believe themselves to be making a decision [4]. However, these signals are recorded over motor-related brain regions and thus are likely to reflect the covert preparation of specific motor programs immediately preceding the execution of a movement [4, 5]. In our study, we can rule out the possibility that decoding during the delay was based on motor preparation. Please note that because the task-relevant stimuli and the response screen occurred in tight temporal sequence, we are unable to separate motor preparation from encoding of intentions during the execution period. An interesting question is whether one could decode which

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task our subjects were going to choose before they were aware of choosing it. Unfortunately, because of the rapid pacing of individual trials, we were not able to reliably analyze the period prior to the cued time of selection. However, an important implication of our study is that in future it might be possible to use decoding to reveal which specific brain areas unconsciously determine the intention that a subject is about to choose [38].

Importantly, we found that overall delay-related activity in prefrontal cortex was indistinguishable under both conditions. There was no evidence, therefore, that preparing to perform one task was more difficult than preparing to perform the other. Furthermore, this finding means that the two intentions are encoded, not by some increase in global activity, but by different spatial response patterns. This raises the intriguing question of the precise neural basis of these cortical patterns encoding different intentions, given that there is a strong overlap between cortical responses to different tasks [39]. One possible explanation may be that cells in specific regions of prefrontal cortex have a functional specialization for either of the two tasks, and that there is a fine-grained clustering of cells with similar properties that is smaller than the size of conventional areas. For example, in visual cortex, information encoded in similar fine-grained patterns of visual cortex can be read out by pattern recognition [12, 13]. This is typically explained as a "biased sampling" or "aliasing" of fine-grained feature columns by the individual fMRI voxels [11–13] and is confirmed by simulations based on realistic neural topographies (see Supplemental Data in [12]). This raises the question whether the informative spatial patterns we found might point to the existence of a similar columnar architecture in prefrontal cortex, where cells might be clustered according to similar roles in selective cognitive control. Such a columnar architecture has been highly debated as a general principle of cortical organization [40, 41] and has been claimed for the prefrontal cortex [42]. Alternatively, our sampling patterns might reflect the sampling of a distributed population code for different tasks as has been proposed from the findings of similar studies on object recognition [14]. Future optical imaging studies will be able to extend our findings by studying the local spatial topography of executive signals in prefrontal cortex. An important question for future studies will be whether the medial prefrontal cortex is *generally* involved in encoding specific tasks during intentional choices or whether encoding in this region is specific for tasks such as the preparation of addition and subtraction.

Taken together, our results extend previous studies on the processing of goals in prefrontal cortex in several important ways. They reveal for the first time that spatial response patterns in medial and lateral prefrontal cortex encode a subject's covert intentions in a highly specific fashion. They also demonstrate a functional separation in medial prefrontal cortex, where more anterior regions encode the intention prior to its execution and more posterior regions encode the intention during task execution. These findings have important implications not only for the neural models of executive control, but also for technical and clinical applications, such as the further development of brain-computer interfaces, that might now be able to decode intentions that go beyond

simple movements and extend to high-level cognitive processes.

Experimental Procedures

Participants and Experimental Design

Three male and five female subjects (age between 21 and 35) gave written informed consent to participate in the experiment, which was approved by the ethics committee at the Institute of Neurology, University College London. All subjects were right-handed and had normal or corrected to normal visual acuity.

At the beginning of each trial, a cue-word ("select") was presented at fixation that instructed the subjects to rapidly select one of the two possible tasks (see Figure 1). This was followed by a variable delay of between 2.7 and 10.8 s, during which the subject was instructed to prepare for the task. Because of the variable delay, the onset time of the task-relevant stimuli was not predictable, requiring the subjects to maintain a state of continuous preparation across the extended delay [10, 15]. Then, the task-relevant stimuli were presented, which consisted of two 2-digit numbers presented above and below the fixation spot. Subjects were instructed to either add or subtract the two numbers in accordance with the task they had previously covertly chosen. Then after 2 s, a "response-mapping" screen was presented that showed four numbers, one in each visual quadrant on the screen. Two of these numbers were correct responses (one for addition and one for subtraction) and two were incorrect responses. Subjects responded with one of four response buttons operated by the left and right index and middle fingers. The keys corresponded to the positions of the four numbers on the "response mapping" screen. Please note that the decoding analysis (see below) was performed on signals related to brain activity prior to onset of the screen with task stimuli and thus 2 s before the response assignment, so decoding could not have been based on covert motor preparation because the mapping of correct and incorrect responses to keys was randomized from trial to trial. The distribution of phase durations during the main experiment (i.e., sequences of N trials where subjects chose the same task) followed an exponential distribution, as would be assumed if subjects chose randomly on each trial which task to perform (Figure S1). Prior to the experiment, subjects practised the task for 7 min. During each scanning run, subjects performed 32 trials.

fMRI Acquisition

A Siemens Allegra 3T scanner with standard head coil was used to acquire functional MRI volumes (42 slices, TR = 2730 ms, resolution $3 \times 3 \times 1.5$ mm³). For each subject, 8 runs of functional MRI data were acquired each with 155 images. To avoid susceptibility artefacts, slices were tilted 20° and the resolution in read-out direction was increased to 1.5 mm. The first three images of each run were discarded to allow for magnetic saturation effects.

Data Analysis

The fMRI data were motion corrected, spatially normalized to a standard stereotaxic space (Montreal Neurological Institute EPI template), and resampled to an isotropic spatial resolution of $3 \times 3 \times 3$ mm³ in SPM2 (<http://www.fil.ion.ucl.ac.uk/spm>). The first analysis was designed to identify brain regions where activity was significantly increased during the delay period while subjects were preparing for the task (Figure S2). This analysis was performed with a general linear model as implemented in SPM2. The model consisted of four boxcar regressors, each convolved with a canonical haemodynamic response function. Each regressor modelled either the delay or execution period of one of the two task types. Prior to the GLM analysis, the data were smoothed with a Gaussian kernel of 6 mm FWHM to account for the anatomical variability across subjects and to satisfy the assumptions of Gaussian random field theory [43].

Pattern Classification

The second analysis was designed to identify regions where spatially distributed fMRI activation patterns carried information about the task the subject was preparing for. First, we estimated a modified general linear model as above but now based on unsmoothed data. This change was made to maximize sensitivity and allow extraction of the full information present in the spatial patterns of prefrontal

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cortex, which would have been reduced by the smoothing. Then, in order to search in an unbiased fashion for informative voxels, we used a novel variant of the "searchlight" approach [44], which examines the information in the local spatial patterns surrounding each voxel v_i (see Figure 2, left). Thus, for each v_i , we investigated whether its local environment contained spatial information that would allow decoding of the current intention.

For a given voxel v_i , we first defined a small spherical cluster of N voxels $c_{1...N}$ with radius of three voxels centered on v_i . For each voxel $c_{1...N}$ in the fixed local cluster, we extracted the unsmoothed parameter estimates for delay-period activity separately for covert preparation of the addition and the selection task. This yielded two N -dimensional pattern vectors $x_{r,1...N}$ and $y_{r,1...N}$ for each run r , representing the spatial response patterns in the local cluster during covert preparation for addition and subtraction. Next, we used multivariate pattern recognition to assess how much intention-related information was encoded in the local pattern. To achieve this, we assigned the pattern vectors $x_{r,1...N}$ and $y_{r,1...N}$ for seven of the eight imaging runs to a "training" data set that was used to train a linear support vector pattern classifier [45] (with fixed regularisation parameter $C = 1$) to correctly identify response patterns related to the two different intentions the subject was currently holding. The classification was performed with the LIBSVM implementation (<http://www.csie.ntu.edu.tw/~cjlin/libsvm>).

The amount of intention-related information present within this local cluster could then be assessed by examining how well the intentions during the remaining independent eighth or "test" data set were classified. Good classification implies that the local cluster of voxels spatially encodes information about the specific current intention of the subject. In total, the training and test procedure was repeated eight times, each with a different run assigned as test data set, yielding an average decoding accuracy in the local environment of the central voxel v_i (8-fold crossvalidation). Then, the procedure was repeated for the next spatial position at voxel v_j . The average decoding accuracy for each voxel was then used to create a 3-dimensional spatial map of decoding accuracy for each position v_i in prefrontal cortex. Because the subjects' images had previously been normalized to a common stereotactic template, it was possible to extend previous local decoding approaches [44] and perform a second-level analysis where we computed on a voxel-by-voxel basis how well decoding could be performed on average across all subjects from each position in the brain. This yielded a spatial map of average decoding accuracy that is plotted in green in Figure 2. We also performed a similar pattern classification with the parameter estimates for task execution as opposed to the delay period. This is plotted in Figure 2 in red.

Supplemental Data

Two Supplemental Figures can be found with this article online at <http://www.current-biology.com/cgi/content/full/17/4/323/DC1/>.

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CV - 09 2504 **ORIGINAL**

US District Court
Eastern District of NY

Gilbert Roman, Plaintiff,

v.
NRO, Defendants,

FILED
AFFIDAVIT/AFFIRMATION
IN CLERK'S OFFICE
U.S. DISTRICT COURT E.D.N.Y.

★ **MAY 29 2009** ★

I Gilbert Roman says the following affirmation under penalty of perjury:

**LONG ISLAND OFFICE
BIANCO, J.**

I Gilbert Roman, am the Plaintiff in the above entitled action, and respectfully move this Court

To issue an ORDER to release all requested information from the defendants.

WALL, M.J.

The reason I am entitled to the relief I seek is the following: Under The Freedom of Information Act

5 USC Sec. 552; and The Privacy Act of 1974; and Under VAUHN v. ROSEN 484 F2d 820 (Dir Cir 1973),

Cert. den. 415 US 977 (1974) an agency must respond properly to a request. They can not fail to

Respond and refuse to respond.

Respectfully Submitted
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